Technical Annexure-I for

Dual Launch Adaptor Version-3 / Version-4

(DLA-V3 / DLA-V4) for PSLV

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1. Introduction

Dual Launch Adaptor (DLA) for PSLV (Fig -1) comprises 3 modules namely an upper CFRP sandwich gridded cone, a middle CFRP sandwich gridded cylinder and a lower hat stiffened cone. All these modules are independently made and assembled to an integral unit through metallic end rings. Here cylinder module is made in 2 heights. Depends on the cylinder height, hardware will be designated as DLA-V3 (2770 mm) and DLA-V4 (2514 mm). However, upper cone & lower cone are same in all aspects for both V3 & V4.

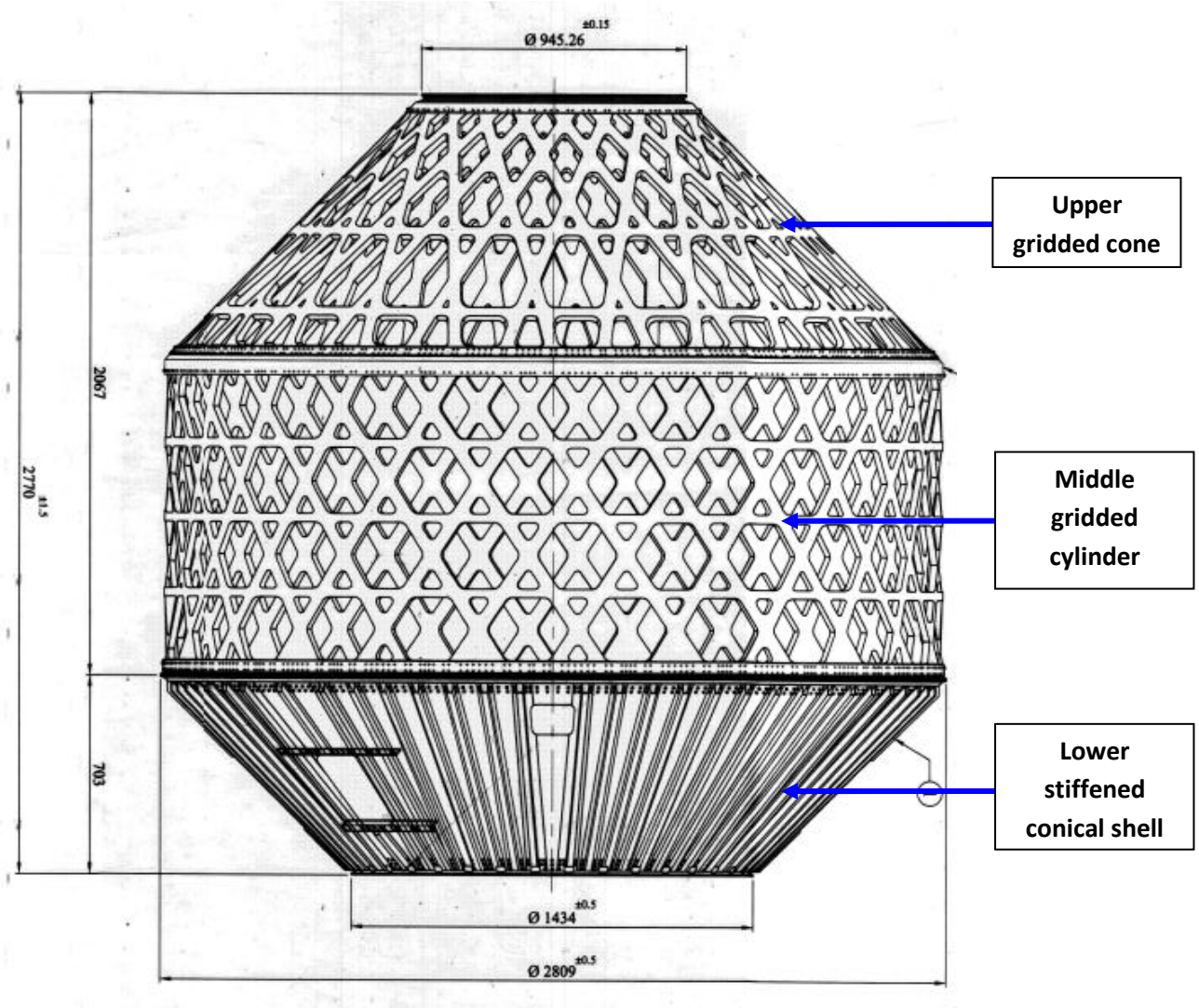

Fig.1. Dual Launch Adaptor (DLA) for PSLV

2. Scope of activity

The scope of activity includes,

a) Realization of upper sandwich cone and assembly to FE & AE rings
b) Realization of middle sandwich cylinder and assembly to AE ring & upper cone.
c) Realization of lower hat stiffened cone and assembly to FE & AE rings

For the realization of all these elements, necessary toolings (moulds & assembly fixtures) mentioned in Table -1, raw materials (carbon prepreg, 'Al' end rings & Ti fasteners) listed in Table -2 will be supplied by VSSC as free issue materials (FIM). All other items not mentioned in Table -1 & 2 and required for the realization /assembly has to be arranged by the party.

Table – 1 : Toolings for DLA fabrication & assembly (FIM)

Sl. No	Name of the Item
1	Mould for fabrication of DLA-Upper gridded cone
2	Aluminum dams for fabrication of DLA-Upper gridded cone
3	Mould for fabrication of DLA-Middle gridded cylinder
4	Aluminum dams for fabrication of DLA-Middle gridded cylinder
5	Mould for fabrication of DLA-Lower stiffened panels & splicers
6	Assembly fixture for DLA-Upper gridded cone
7	Assembly fixture for DLA-Middle gridded cylinder
8	Assembly fixture for DLA-Lower cone

Table – 2 : Raw material for DLA fabrication (FIM)

Sl. No	Raw Materials
1	HTS/M18 carbon UD prepreg
2	20mm thick, 2.3 pcf Al. Honeycomb Core (CR-III-1/4-5056-.001P).
3	Redux 319L (180 gsm) film adhesive.
4	Redux 219/2NA foam adhesive.
5	Composilok fasteners
6	MAF fasteners
7	M4 Titanium conventional fasteners, washers & nuts
8	Aluminium end rings
9	Aluminium bulkheads

10	Handling brackets
11	EPG 2601 Part A & Part B for bonding
12	Micro balloon power for potting

3. Processing of DLA CFRP upper gridded cone, Middle gridded cylinder and lower stiffened panels:

3.1 List of Consumables required for processing: (To be procured by vendor)

3.1.1 Teflon coated F/G cloth with one side adhesive

3.1.2 Teflon release film (Perforated)

3.1.3 Breather material, Air weave N7 or A-3000-7

3.1.4 Bleeder material, Air weave, N4

3.1.5 Sealant Putty, GS 43 MR or SM-5126

3.1.6 Polyester film

3.1.7 Acetone/Trichloroethylene

3.1.8 Vacuum Bag film WL 8400 or Capron 980

3.1.9 Release Agent QZ-13

3.1.10 Thermocouple

3.2 Toolings / Equipments:

3.2.1 Moulds and assembly fixtures (FIM) – refer Table-1.

3.2.2 GFRP Caul Plates.

3.2.3 Autoclave / Oven with $\pm$ 1^{o} C uniformity.

3.2.4 Cold storage with -20 deg C range.

3.2.5 Prepreg cutting machine (preferable)

3.3 Sequence of Operations for realisation of gridded Upper Cone (drg no.H301-81205-R1)

3.3.1 Brief description of gridded Cone

The DLA-V4 CFRP upper cone is a gridded sandwich shell construction in single sector of 360^{0} (refer Fig.2 for Gridded sandwich shell construction of Cone). The gridded Cone has 4 Nos. of circumferential members and 48 Nos. of Helical members (24 helical members each in clockwise and anticlockwise

direction). The helical and circumferential members are made of CFRP sandwich with face skin material of HTS/M18 UD prepreg and 20 mm Al alloy core (CR-III-1/4-5056-.001P). The helical member thickness is 21.98 mm (each face skin 0.99 mm thick and 20 mm core) and the circumferential member thickness is 21.76 mm (each face skin 0.88 mm thick and 20 mm core). The lay-up sequence is listed in **Table- 3**.

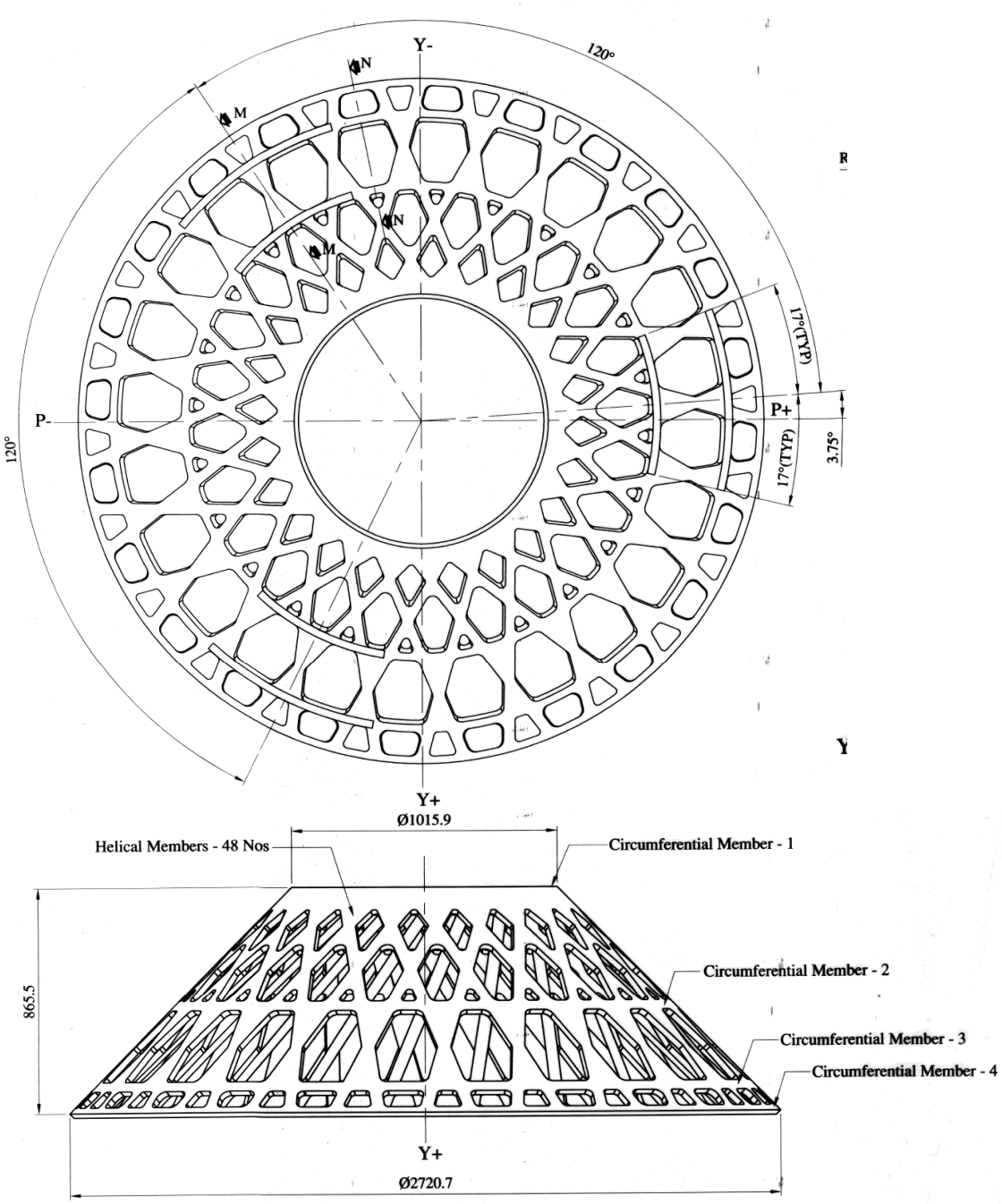

Fig. 2. Gridded sandwich shell construction of Cone

Table-3: Layup details at various regions of gridded cone

Location	Lay up Sequence
Helical members (0.99mm skin+20mm core +0.99mm skin)	0/0/+45/-45/0/-45/+45/0/0/20 mm core/0/0/+45/-45/0/-45/+45/0/0
Circumferential members (0.88mm skin+20mm core +0.88mm skin)	+45/-45/-45/+45/+45/-45/ -45/+45/20 mm core/ +45/-45/-45/+45/+45/-45/-45/+45
Ring to shell joint at both end of the cone– Additional reinforcement of 8 layers on each skin is provided.	+45/-45/+45/-45/+45/-45/+45/-45

NB: Sandwich beam axis is taken as the 0^0 reference axis for lay-up.

3.3.2 Sequence of activity:

- Prepare the metallic mould for processing, like cleaning, marking for product size etc.
- Preparation of honey comb core for the gridded conical shell processing (refer 3.3.3).
- Do the Inner skin lay-up (refer Table-3 & Fig. 3).
- Position Film adhesive over the inner skin.
- Position the already prepared Honey comb core (refer 3.3.3 & Fig 3) over the film adhesive.
- Position the Film adhesive over the already positioned honey comb core.
- Do the Outer skin lay-up (refer Table-3 & Fig. 3).
- Complete the vacuum bag (refer 3.3.4).
- Subject the vacuum bagged lay-up for curing (refer 3.3.5).
- Extract the shell from the mould after unloading from autoclave/oven.
- Extraction of control coupons.
- Trimming of gridded conical shell as per applicable drawings. (Drg. No:H301-81205-R1).

- Control coupons testing (edge wise compression test: specimen size of 80 x 25 mm, 10 nos)
- NDT of gridded conical shell (Ultrasonic Testing)
- Inspection of gridded conical shell

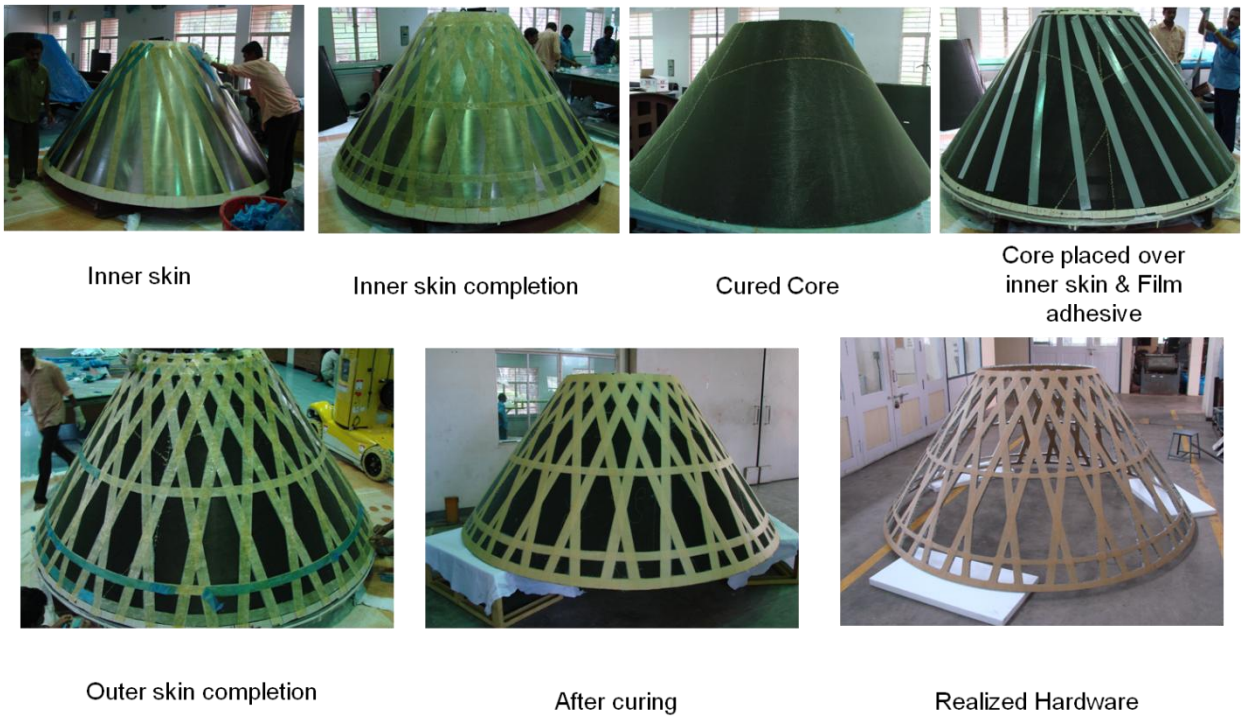

Fig.3 : Typical processing of gridded cone fabrication

3.3.3 Honey comb core (CR-III-1/4-5056-.001P) preparation:

- Clean the mould for the core processing.
- Fix the Aluminium dams at the AE & FE side on the mould
- Identify the core as per designation
- Clean the core using TCE/acetone.
- Prepare the core (core joining using Kevlar rovings & foam adhesive) to make it 360 deg shell.
- At all core joint locations, put one layer of foam adhesive (Redux 219/2NA foam adhesive).
- Place the joined core in position over the mould and tie it with the mould using cotton tape and high temperature tape to adjust it with the mould curvature. Keep rubber pads at the core joint locations.
- Remove the cotton tape before curing.

- Cure the prepared core under vacuum (0.8 bar – min) at 175 deg C for 1 hr.
- Demould the core from the mould & store it safely for further processing.

3.3.4 Vacuum bagging.

- After completing the lay up as mentioned in 3.3.2, put 1 layer of Teflon release film, 1 layer of bleeder, 1 layer of breather and finally vacuum bag the entire lay-up.
- Provide thermo couple, vacumm nipple etc and position inside autoclave for curing.

3.3.5 Curing:

- Connect all vacuum lines to the nipple & ensure the perfect vacuum.
- Switch on the heater & cure for a set temperature of 175 Deg C for 2 hrs under a vacuum of 0.8 bar (min).
- After dwell period, allow it to cool under vacuum till it reaches 60 deg. C.
- Once it reaches RT, unload from auto clave & demould the product.

3.3.6 Quantity : No of Gridded conical shell requirement: **04 nos.**

3.4 Sequence of Operations for realisation of middle gridded Cylinder (drg no: H301-81204 R0 - for Version-3 & H301-82204 R0 - for Version-4)

3.4.1 Brief description of gridded Cylinder

The DLA CFRP cylinder is of gridded sandwich shell construction. The gridded cylinder has circumferential members (5 Nos. for Version-3 & 4 nos. for Version-4) and 48 Nos. of Helical members. The CFRP gridded cylindrical shell will be made in single sector of 360^0 (Refer **Fig.4** for Gridded sandwich shell construction of Cylinder). The helical and circumferential members are made of CFRP sandwich with face skin material of HTS/M18 UD prepreg and 20 mm Al alloy core (CR-III-1/4-5056-.001P). The helical member thickness is 21.98 mm (each face skin 0.99 mm thick and 20 mm core) and the circumferential member thickness is 21.76 mm (each face skin 0.88 mm thick and 20 mm core). The lay-up sequence at various locations on the gridded

cylindrical shell (version-3) is shown in **Table-4** (for version-4 also the operations are similar except reduction in one circumferential member).

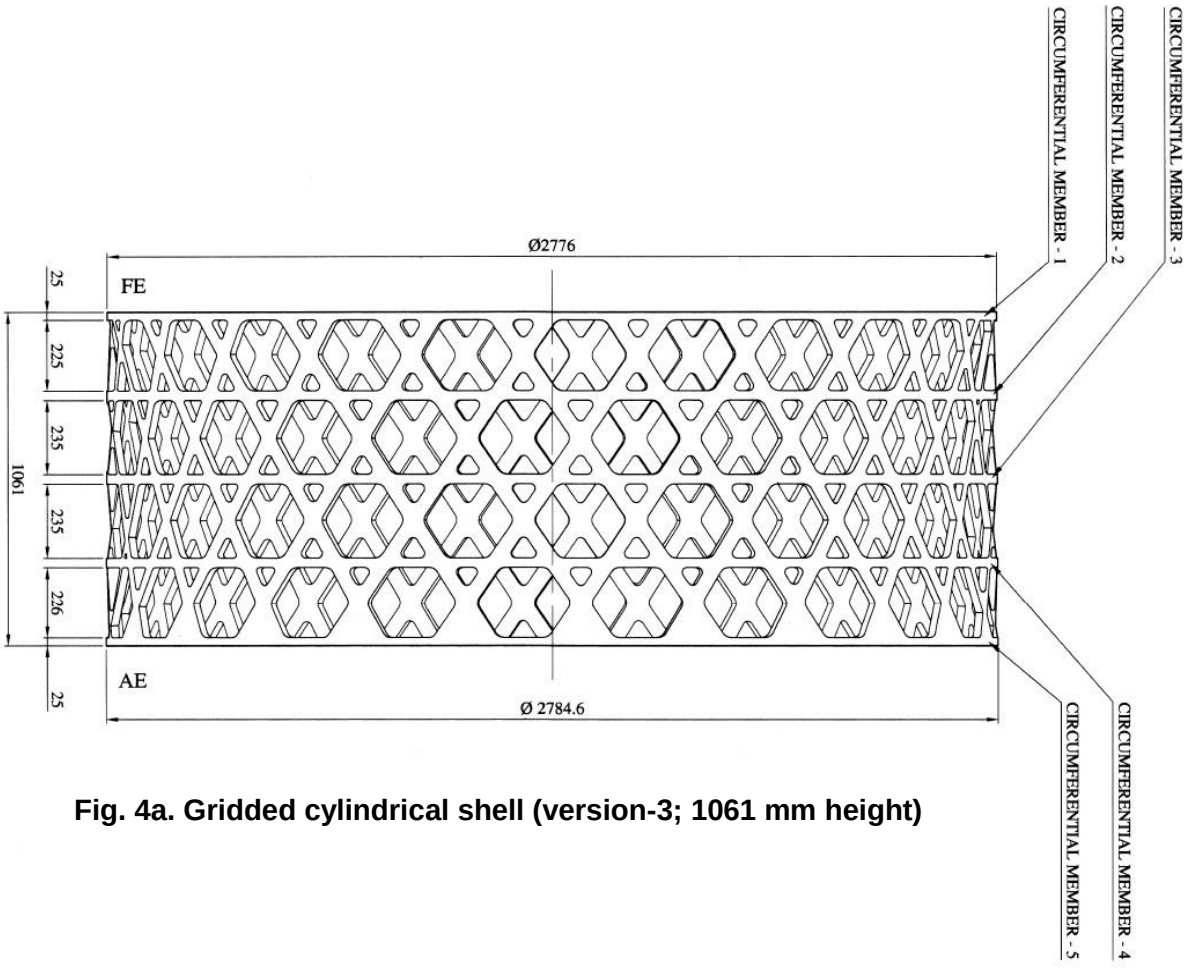

Fig. 4a. Gridded cylindrical shell (version-3; 1061 mm height)

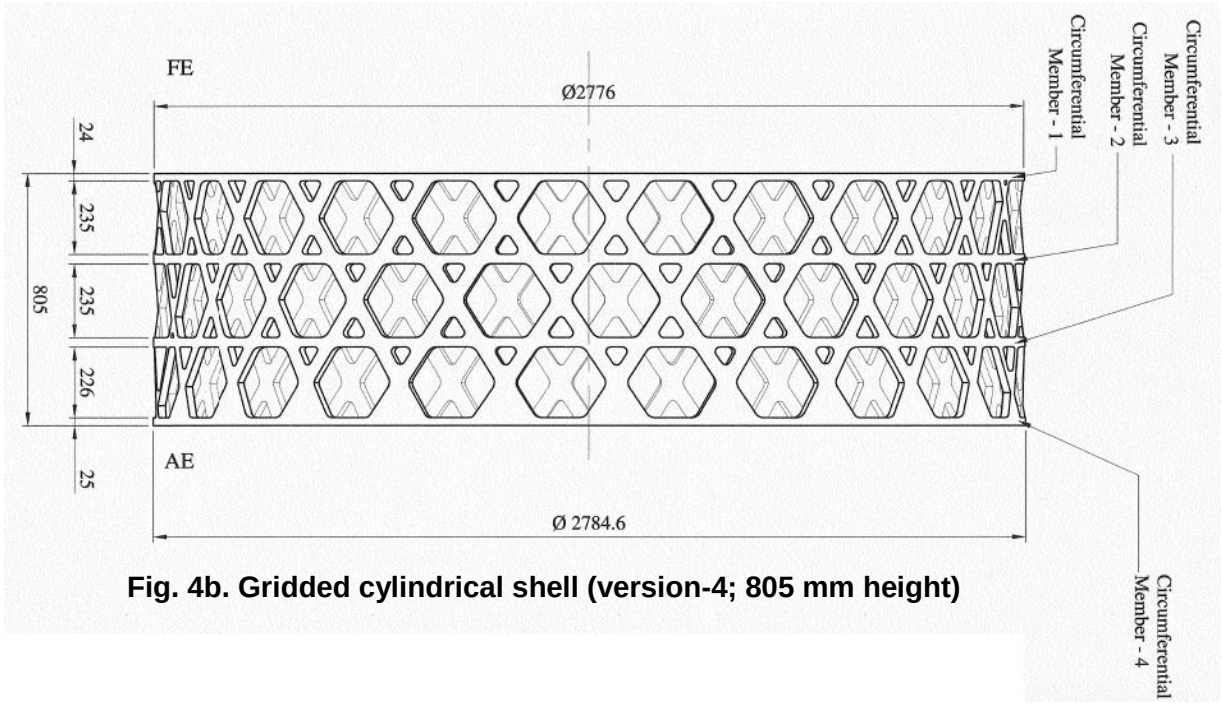

Fig. 4b. Gridded cylindrical shell (version-4; 805 mm height)

Table – 4: Layup details at various regions of gridded cylinder

Location	Lay up Sequence
Helical members (0.99mm skin+20mm core +0.99mm skin)	0/0/+45/-45/0/-45/+45/0/0/20 mm core/0/0/+45/-45/0/-45/+45/0/0
Circumferential members (0.88mm skin+20mm core +0.88mm skin)	+45/-45/-45/+45/+45/-45/ -45/+45/20 mm core/ +45/-45/-45/+45/+45/-45/-45/+45
Ring to shell joint – Additional reinforcement of 8 layers on each skin is provided.	+45/-45/+45/-45/+45/-45/+45/-45
In the sandwich beam overlap regions, the honey comb core thickness of 20 mm is maintained and the skins of the beam alone have the overlap.	

NB: Sandwich beam axis is the 0^0 reference axis

3.4.2 Sequence of activity:

- Prepare the metallic mould for processing, like cleaning, marking for product size etc.
- Preparation of honey comb core for the grid cylindrical shell processing (refer 3.3.3).
- Do the Inner skin lay-up (refer **Table-4** & **Fig. 5**).
- Position Film adhesive over the inner skin.
- Position the already prepared Honey comb core (refer 3.3.3 & **Fig. 5**) over the film adhesive.
- Position the Film adhesive over the already positioned honey comb core.
- Do the Outer skin lay-up (refer **Table-4** & **Fig. 5**).
- Complete the vacuum bag (refer 3.3.4).
- Subject the vacuum bagged lay-up for curing (refer 3.3.5).
- Extract the shell from the mould after unloading from autoclave/oven.

- Extraction of control coupons.
- Trimming of gridded conical shell as per applicable drawings. (Drg. No:H301-81205-R1).
- Control coupons testing (edge wise compression test: specimen size of 80 x 25 mm, 10 nos)
- NDT of gridded conical shell (Ultrasonic Testing)
- Inspection of gridded cylindrical shell

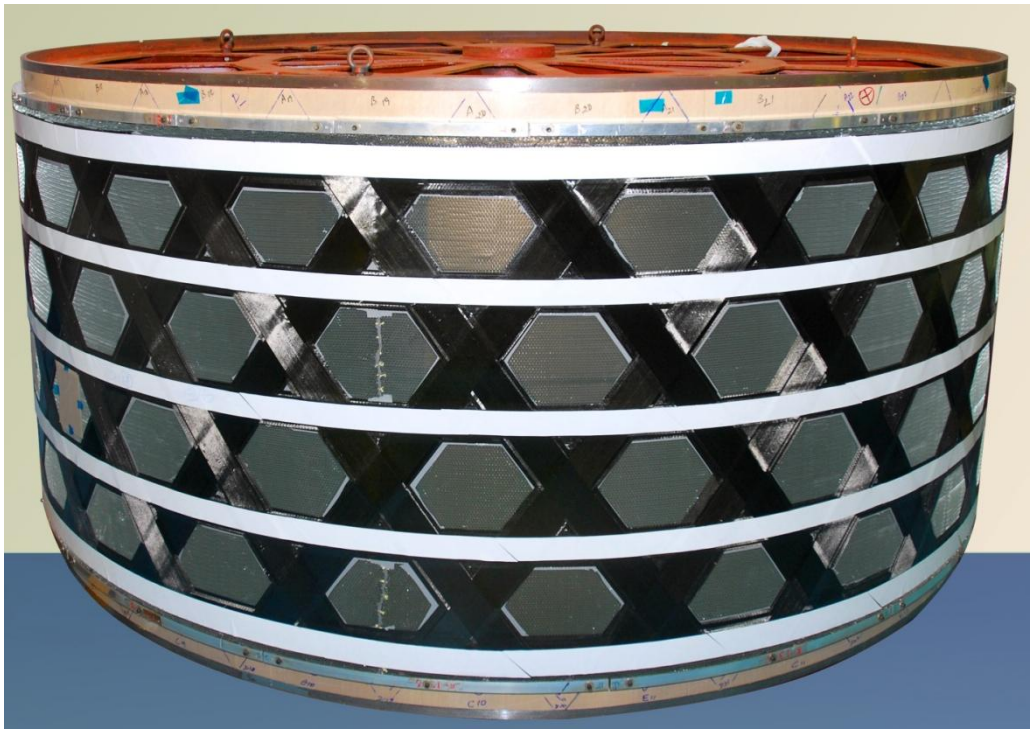

Fig. 5 : Typical processed gridded cylindrical shell

3.4.3 Quantity : No of Gridded cylindrical shell requirement

3.4.3.1.1 Gridded cylindrical shell version-3: 02 nos.

3.4.3.1.2 Gridded cylindrical shell version-4: 02 nos.

3.5 Sequence of operations for realisation of lower hat stiffened conical panels and splicers (drg no: H301-81103 to H301-81108)

3.5.1 Brief description of DLA lower hat stiffened cone

The DLA-L is stringer-stiffened shell having the hat cross-section for the stringers made with HTS/M18 UD carbon prepreg. DLA-L has four sectors of stiffened panels and inner and outer splicers (each 04 nos.) are used for joining the sectors circumferentially. The hat stiffened panels will be assembled with 'Al' end rings to form the stiffened conical shell (refer **Fig.6**). Each panels and splicers has to be fabricated as per applicable drawings. The lay-up sequence at various locations of the stiffened panel is shown in **Table-5.**

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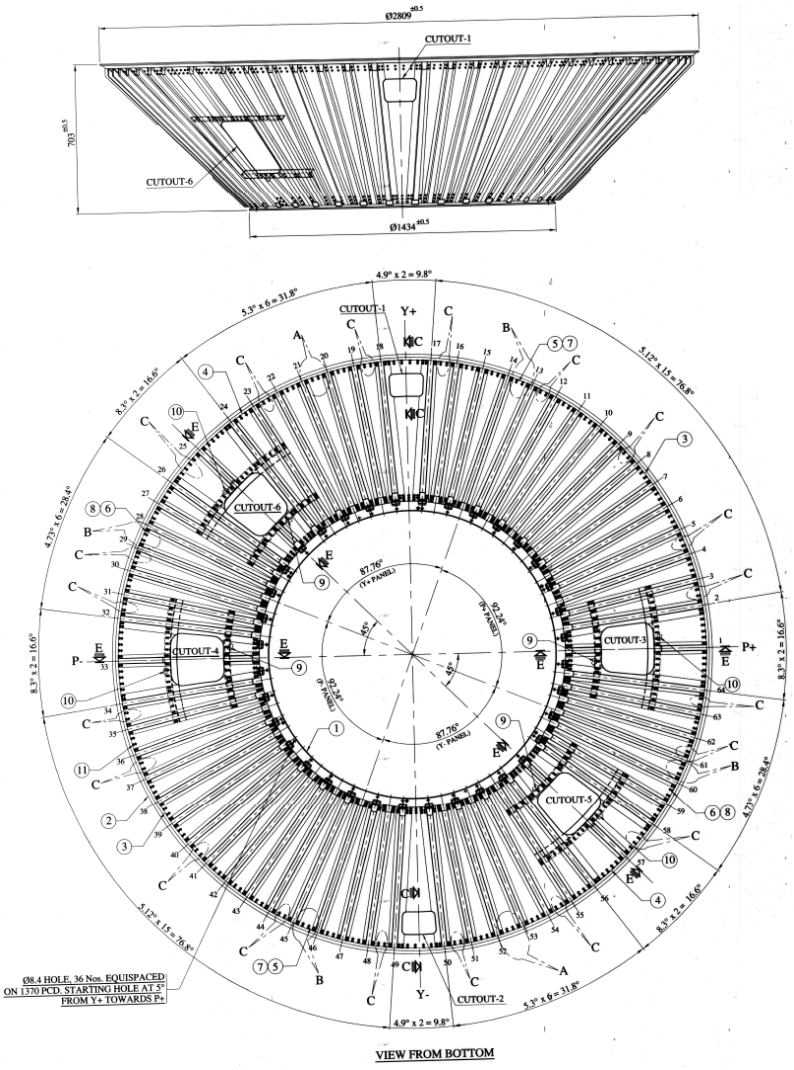

Fig. 6. Configuration details of DLA – L

TABLE – 5: DLA-L Lay-up details at various regions of the shell

Location	Lay up Sequence
Basic Shell – 10 layers (1.1 mm thick)	(0/+30/+60/-30/-60)s
Basic Shell reinforcements in the cutout sides covering upto 2 hats – 6 layers (1.76 mm thick)	((0/+30/+60/-30/-60)s)/ +45/-45/+45/-45/+45/-45
Hat stiffener Flange – 8 layers (0.88 mm thick) Web – 8 layers (0.88 mm thick) Crown - 10 layers (1.1 mm thick)	 +45/-45/-45/+45/-45/+45/+45/-45 +45/-45/-45/+45/-45/+45/+45/-45 +45/-45/-45/+45/0/0/-45/+45/+45/-45
Cut out -Hat stiffener Flange – 20 layers (2.2 mm thick) Web – 16 layers (1.76 mm thick) Crown - 20 layers (2.2 mm thick)	 (+45/-45/-45/+45/0/0/-45/+45/+45/-45)s (+45/-45/-45/+45/-45/+45/+45/-45)s (+45/-45/-45/+45/0/0/-45/+45/+45/-45)s
Additional reinforcement in between hat flanges in the ring to shell joint locations (FE & AE side) – 10 layers (1.1 mm)	+45/-45/+45/-45/+45/-45/+45/-45/+45/-45
Additional reinforcement in between hat flanges above the small cut-out in the ring to shell joint locations – 6 layers (0.66 mm)	+45/-45/+45/-45/+45/-45
Bulkheads (3 mm thick) - Al alloy	

NB: Cone axis is the 0^0 reference axis

3.5.2 Sequence of activity for realisation of stiffened panels and splicers

- Prepare the metallic mould and 'Al' hat mandrels for processing, like cleaning, marking for product size etc.
- Do the basic shell lay-up (refer **Table-5**).
- Do the basic shell reinforcement lay-up (refer **Table-5**) as per the respective panels configuration (P+, P- panels: drg no: H301-81103 & Y+ & Y- panels: drg no: H301-81104).
- Fix the 'Al' Hat mandrels on the mould as per the respective panels configuration (P+, P- panels: drg no: H301-81103 & Y+ & Y- panels: drg no: H301-81104).
- Do the hat stiffener skin lay-up (refer **Table-5**).
- Do the cut-out hat stiffener skin lay-up (refer **Table-5**).
- Do the additional reinforcement lay-up between hat stiffeners (refer **Table-5**) as per the respective panels configuration (P+, P- panels: drg no: H301-81103 & Y+ & Y- panels: drg no: H301-81104)
- Complete the vacuum bag (refer 3.3.4).
- Subject the vacuum bagged lay-up for curing (**refer 3.5.3**).
- Extract the stiffened conical shell sector from the mould after unloading from autoclave.
- Repeat the above process for the fabrication of all the 4 panels (P+, P- , Y+ & Y-) and inner splicers type-1 & 2 (each 02 nos.) and outer splicers type-1 & 2 (each 02 nos.)
- Extraction of control coupons for flexural testing (3 point bending, specimen size: 80 mm long x 25 mm width; 10 nos.) from respective panels.
- Trimming of stiffened segmented panels and splicers as per applicable drawings. (Drg. No: **H301-81103 to H301-81108**).
- Control coupon testing for respective panels
- NDT of stiffened panels and inner, outer splicers (Ultrasonic Testing)
- Inspection of stiffened panels and splicers
- The typical stiffened panel and splicers are shown in Fig. 7 for reference.

3.5.3 Curing:

- Connect all vacuum lines to the nipple & ensure the perfect vacuum.
- Switch on the heater & cure for a set temperature of 175 Deg C for 2 hrs under **a vacuum of 0.8 bar (min) with 4 bar pressure**.
- After dwell period, allow it to cool under vacuum till it reaches 60 deg. C.
- Once it reaches RT, unload from autoclave & demould the product.

(a) Stiffened panel (b) Inner splicer (c) Outer splicer

Fig. 7 : Typical processed stiffened panel and splicers

3.5.4 Quantity requirement:

3.5.4.1 No of stiffened panels :

Y+ panels - 4 nos, Y- panels - 4 nos,

P+ panels - 4 nos, P- panels - 4 nos.

3.5.4.2 No of inner splicers type-1 –08 nos

3.5.4.3 No of inner splicers type-2 –08 nos

3.5.4.4 No of outer splicers type-1 –08 nos

3.5.4.5 No of outer splicers type-2 –08 nos

4. Assembly of Dual Launch adaptor

The DLA V3 / V4 consist of two parts, namely DLA-Upper and DLA-Lower. The overall configuration of DLA assembly is shown in Fig.1 (refer Drg. No. H301-81000 for DLA-V3 & Drg. No. H301-82000 for DLA-V4).

4.1 List of Consumables required for assembly: (To be procured by vendor)

4.1.1 QZ-13 or equivalent releasing agent.

4.1.2 Polyester film.

4.1.3 Cleaning Agent - Trichloroethylene or IP.

4.1.4 Teflon release film – Perforated (0.08mm thick)

4.1.5 Breather material, Air weave N7 or A-3000-7

4.1.6 Bleeder material, Air weave, N4

4.1.7 Sealant Putty, GS 43 MR or SM-5126

4.1.8 Vacuum Bag film WL 8400 or Capron 980

4.1.9 Polythene Sheet.

4.1.10 M5 Conventional Service fasteners.

4.1.11 Emery Papers

4.2 Toolings / Equipments:

4.2.1 Assembly Fixture for DLA-Upper Cone (FIM)

4.2.2 Assembly Fixture for DLA-Upper Cone & Cylinder (FIM)

4.2.3 Connecting brackets for Assembly Fixture(FIM)

4.2.4 Assembly Fixture for DLA-Lower Assembly (FIM).

4.2.5 Hand Drilling machine (Electriacal, Pneumatic or Battery operated)

4.2.6 Steel Rule / Measurement tape

4.2.7 Vernier Caliper.

4.2.8 Saber-Saw Cutting Machine

4.2.9 Diamond Coated Blades

4.2.10 M5 Conventional fasteners (service screws for dry assembly)

4.2.11 M4 conventional fasteners (service screws for dry assembly)

4.2.12 Cliko Pins.

4.2.13 Pneumatic Torque Wrench

4.2.14 Mechanical Torque Wrench

4.2.15 Composi-lok Installation Kit.

4.2.16 MAF Fasteners Installation Kit.

4.2.17 Torque adaptors

4.2.18 Allen Keys

4.2.19 Spanners

4.2.20 C-clamps

4.2.21 Parallel Clamps

4.2.22 Steel stands

4.2.23 Dust collection System

4.2.24 Vacuum port Nipple – VV 401

4.3 Sequence of operations for assembly of DLA Upper (drg no: H301-81200 - for Version-3 & H301-82200 - for Version-4)

4.3.1 Brief description of DLA upper assembly

The DLA-U consists of two parts namely CFRP gridded cone and CFRP gridded cylinder which are assembled to fore end ring at forward portion of gridded cone, transition ring between cone aft ward portion and cylinder forward portion, and aft end ring to the cylinder aft ward portion. The end rings of DLA are made out of aluminium alloy AA2014-T652. Titanium Composi-lok and MAF fasteners will be used for fastening CFRP gridded cone and cylinder to end rings (Drg. No. H301-81200 for configuration of DLA-V3-Upper & Drg. No. H301-82200 for configuration of DLA-V4-Upper)

4.3.2 Sequence of activity

4.3.2.1 Prepare the assembly fixture by cleaning all the machined surfaces of the assembly fixture with TCE/Acetone where the aluminium rings are to be placed.

4.3.2.2 Position the assembly fixture for DLA-Upper cone in a convenient flat form having provision for persons to enter inside the fixture.

4.3.2.3 Position the Transition Ring (Drg.No. H301-81202) at aft end of the fixture with reference to the V notch at Y+ axis in the ring and lock it with fasteners using holes provided for assembly.

4.3.2.4 Position the trimmed gridded cone with by aligning the Y+ axis of the cone with the Y+ axis of the transition ring by inserting from top.

4.3.2.5 Position the FE ring (Drg.No. H301-81203) with reference to the V notch at Y+ axis and the tooling hole in fixture and ring and fix the ring.

4.3.2.6 Position the FE ring and transition ring aluminium splicers (Drg.No. H301-81209 & Drg.No. H301-81208) and drill the interface holes on the rings to the CFRP gridded cone as per the applicable drawing (refer Drg.No. H301-82200).

4.3.2.7 Initially drill Dia.3 mm pilot holes then enlarge to Dia.5.1 mm holes for assembly.

4.3.2.8 Use Cliko pins to clamp at blind hole locations (i.e., end ring to aluminum splicer locations) and use conventional service screws for through hole locations.

4.3.2.9 Complete the entire hole drilling process for the gridded cone assembly.

4.3.2.10 Prepare the assembly fixture for DLA-Upper (Cone &Cylinder) assembly by cleaning all the machined surfaces of the assembly fixture with TCE/Acetone where the aluminium rings are to be placed.

4.3.2.11 Position the aft end ring for cylinder (Drg.No. H301-81201) at aft end of the fixture with reference to the V notch at Y+ axis and fix it with fasteners at the holes provided

4.3.2.12 Position the trimmed cylinder by aligning the Y+ axis of the Cylinder with the Y+ axis of the aft end ring by inserting from top.

4.3.2.13 Take out the already dry assembled DLA-Upper Cone from the Assembly Fixture.

4.3.2.14 Fix the Connecting brackets (12 nos.) with the Transition Ring of DLA-Upper as given in Fig. 17.

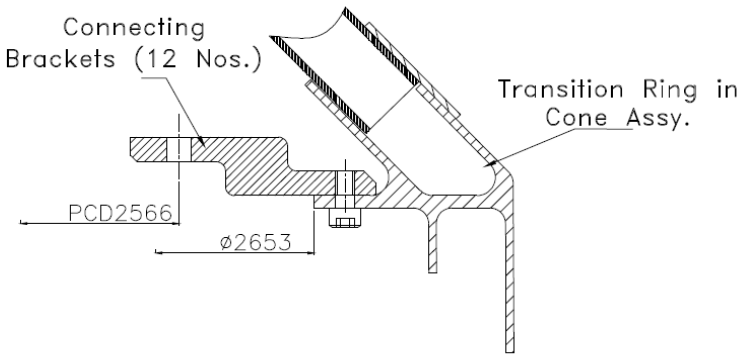

Fig. 17. Details of Connecting brackets assembly with transition Ring

4.3.2.15 Position the DLA-Upper cone assembly by inserting from top and coinciding the Y+axis of the cone assembly with the Y+ axis of the cylinder assembly fixture and fix it using connecting brackets.

4.3.2.16 Position the cylinder AE ring (drg no: H301-81206) and transition ring aluminium splicers (cylinder side; drg no: H301-81207) and drill the interface holes on the rings to the CFRP gridded cylinder as per the applicable drawing (Drg.No. H301-82200).

4.3.2.17 Initially drill Dia.3 mm pilot holes then enlarge to Dia.5.1 mm holes for assembly.

4.3.2.18 Use Cliko pins to clamp at blind hole locations (i.e., end ring to aluminum splicer locations) and use conventional service screws for through hole locations.

4.3.2.19 Complete the entire hole drilling process for the gridded cylinder assembly.

4.3.2.20 Prepare the hardware for wet assembly by dismantling one joint at a time and de-burring of the fastener holes on the rings.

4.3.2.21 Also carry out emerying on the bond area of the gridded shell as well as on the Al. alloy rings using 200 grade emery paper

4.3.2.22 Clean the bonding surfaces of the CFRP shell and rings with TCE/IP solution.

4.3.2.23 Apply the EPG 2601 part A & B by thoroughly mixing in ratio 100:15 by weight and apply on the bonding surfaces and also fastened the ring to CFRP shell by using Composilok & QZ applied service fasteners at the MAF locations. Apply Torque of 1 Nm. For the service screws MAF fasteners.

4.3.2.24 Clean the excess resin flow by using TCE/IP and allow to cure for 24 hours (min) at room temperature without any disturbance.

4.3.2.25 After the Curing, remove the M5 service screws one by one, clear the hole by using Dia.5.2 Drill bit and install MAF Fasteners (Sleeve and Collar). Apply Torque of 1 Nm for the Sleeve by using Torque Wrench available with the MAF installation kit. Installation of Collar to be carried out by using the pneumatic tool. Pneumatic pressure of 5 – 6.5 bar to be maintained.

4.3.2.26 Follow the similar procedure to complete the wet assembly of all the joints of DLA-upper.

4.3.2.27 Do the dimensional inspection of the DLA-Upper assembly as per assembly drawing (refer Drg. No: H301-81200 for DLA-V3 & Drg. No: H301-82200 for DLA-V4).

4.3.2.28 Do the NDT of DLA-Upper assembly at all bonded interface as per the NDT plan (Refer Report No: VSSC/CPSG/CNDT/WI).

4.4 Sequence of operations for assembly of DLA Lower (drg no: H301-81100)

4.4.1 Brief description of DLA Lower assembly

The DLA-V3-Lower is stringer-stiffened shell having hat cross-section for the stringers. The CFRP shell is made in 4 sectors (P Panel – 02 Nos., Y Panels – 02 Nos.) and joined by splicers from inside and outside. The CFRP panels are connected by Al end rings at fore end and aft sides. Titanium Composi-lok fasteners will be used for fastening CFRP panels to end Rings (Drg. No. H301-81100).

4.4.2 Sequence of activity

4.4.2.1 Prepare the assembly fixture by cleaning all the machined surfaces of the assembly fixture with TCE/Acetone where the aluminium rings are to be placed.

4.4.2.2 The Fixture setup is in such a way that the Fore End is at bottom and Aft end is at top due to the inverted Cone configuration of DLA-Lower.

4.4.2.3 Position and lock the Fore End Ring (Drg.No. H301-81102) at bottom side of the fixture with reference to the V notch at Y+ axis and aft end ring at top side of the fixture with reference to the V notch at Y+ axis (Drg.No. H301-81101).

4.4.2.4 Position the already trimmed Y+ Panel in the fixture in such a way that the Y+ axis of the Panel coincide with the Y+ axis of the Aft end and Fore End Ring. Clamp the Panel in position using C clamps at Fore End and aft end.

4.4.2.5 Similar way position and clamp the trimmed Y-, P+ & P- panels with reference to the corresponding axis marks on the ring and panels.

Circumferential gap of 1mm (max) to be provided between adjacent panels.

4.4.2.6 Drill the holes from outside through the CFRP panels and rings except the splicer joint locations. Complete the dry assembly of all the 4 panels.

4.4.2.7 Suit the inner and outer splicers with CFRP Panels at all the four panels joint. Mark and drill the holes at interface fastener locations for connecting splicers to CFRP panels & end rings as per the Drawing No. H301-81100.

4.4.2.8 Handling Brackets and bulkheads (top & bottom at cutouts) to be suited and drilled per the Drawing No. H301-81100.

4.4.2.9 Prepare the hardware for wet assembly by dismantling splicers at all the four locations and Y+ Panel from the assembly without disturbing the other 3 panels.

4.4.2.10 Carry out emerying on the bond area of the panel as well as on Al. alloy ring by using 200 grade emery paper.

4.4.2.11 Carry out de-burring of the fastener holes on the rings.

4.4.2.12 Clean the bonding surfaces of the panels and rings with TCE/IP solution.

4.4.2.13 Apply the EPG 2601 part A & B by thoroughly mixing in ratio 100:15 by weight and apply on the bonding surfaces and also fastened the ring to CFRP shell by using Composilok fasteners.

4.4.2.14 Install Composi-lok fasteners at corresponding locations. Apply required torque by using the pneumatic tool for Composi-lok fasteners. Pneumatic pressure of 5 – 6.5 bar to be maintained.

4.4.2.15 Clean the excess resin flow by using TCE/IP and similarly complete all the other three panels.

4.4.2.16 Allow to cure for 24 hours (min) at room temperature without any disturbance.

4.4.2.17 Identify the splicers for Y+/P+ joint. Carry out emerying on the bonding surface of the splicer and panels. Clean the bonding surfaces with TCE/IP solution.

4.4.2.18 Bond and fasten the splicers using M4 Titanium conventional fasteners. Clean the excess resin from the surfaces and also vacuum bagging around the splicer joint area for envelope bagging. Apply 0.8 bar

vacuum. Run the vacuum pump for 5 hours. Allow to cure for 24 hours (min) at RT with 0.8 bar vacuum without any disturbance.

4.4.2.19 Similar way complete the wet assembly operations at other three splicer joint locations.

4.4.2.20 Do the dimensional inspection of the DLA-Lower assembly as per the Drg. No. H301-81100).

4.4.2.21 Do the NDT of DLA-Lower assembly at all bonded interface as per the NDT plan (Refer Report No: VSSC/CPSG/CNDT/WI).

5. Packing and dispatch to VSSC

5.1 Assemble the DLA-Upper and DLA-Lower using clamp joints (will be co-ordinated by VSSC at vendor site)

5.2 Packing and placing it in transportation container and dispatch to VSSC.

6. No. of DLA-V3 / V4 assembly requirement: 04 nos.